CLAIMS

[1] A conductive thin film formed by mixing a first material having electric conductivity or semiconductivity and a second material to prepare a mixture and orienting the mixture by utilizing liquid crystallinity thereof.

[2] The conductive thin film according to claim 1, which is formed by mixing at least nanotube comprising at least one of metallic nanotube and semiconductive nanotube and a liquid crystalline organic compound together and orienting molecules of the liquid crystalline organic compound to cause molecules of the nanotube to be oriented.

[3] The conductive thin film according to claim 2, wherein said nanotube is carbon nanotube.

[4] The conductive thin film according to claim 2, wherein said liquid crystalline organic compound is a liquid crystalline organic compound having at least one of a nematic liquid crystalline phase and a smectic liquid crystalline phase.

[5] The conductive thin film according to claim 2, wherein said liquid crystalline organic compound is a liquid crystalline organic compound having a charge transport function.

[6] The conductive thin film according to claim 2, wherein said liquid crystalline organic compound is a liquid crystalline organic compound having at least l 6π-electron aromatic rings, m 10π-electron aromatic rings or n 14π-electron aromatic rings (wherein l+m+n = 1 to 4; and l and n are each an integer from 0 to 4).

[7] The conductive thin film according to claim 6, wherein said liquid crystalline organic compound is a liquid crystalline organic compound having at

least any one of a 2-phenylnaphthalene ring, a biphenyl ring, a benzothiazole ring and a t-thiophene ring and a substantially rod-like molecular structure.

[8] The conductive thin film according to claim 1, which is formed by mixing at least a non-liquid-crystalline organic semiconductor compound and a non-liquid-crystalline organic compound to form a liquid crystalline organic semiconductor mixture and orienting molecules of the liquid crystalline organic semiconductor mixture to cause molecules of the organic semiconductor compound to be oriented.

[9] The conductive thin film according to claim 8, wherein said liquid crystalline organic semiconductor mixture is a liquid crystalline organic semiconductor mixture in which said organic semiconductor compound and said organic compound are hydrogen-bonded to each other.

[10] The conductive thin film according to claim 9, wherein one of said organic semiconductor compound and said organic compound is a compound having at least one element selected from nitrogen, oxygen, sulfur and halogen and the element selected is hydrogen-bonded to hydrogen.

[11] The conductive thin film according to claim 10, wherein the one of said organic semiconductor compound and said organic compound which has at least said element selected is a compound further having at least one of an unsaturated bond and a benzene ring.

[12] The conductive thin film according to claim 8, wherein said organic semiconductor compound is a derivative comprising an organic semiconductor compound of at least any one of an acene type, a phthalocyanine type and a thiophene type.

[13] The conductive thin film according to claim 12, wherein the derivative comprising an organic semiconductor compound of said acene type is a

pentacene derivative.

[14] The conductive thin film according to claim 12, wherein the derivative comprising an organic semiconductor compound of said phthalocyanine type is a copper phthalocyanine derivative.

[15] The conductive thin film according to claim 8, which is formed by orienting molecules of said organic semiconductor mixture to cause molecules of said liquid crystalline organic semiconductor compound to be oriented and then removing said organic compound from said liquid crystalline organic semiconductor mixture.

[16] The conductive thin film according to claim 15, which is formed by removing said organic compound from said liquid crystalline organic semiconductor mixture by at least one of heating and ultraviolet irradiation.

[17] The conductive thin film according to claim 1, which is formed by mixing at least an organic semiconductor compound having a first liquid crystalline phase in which crystallization temperature allowing crystallization from the liquid crystalline phase to occur is not lower than room temperature and an organic compound exhibiting a second liquid crystalline phase of a lower orientational order than the first liquid crystalline phase within a temperature range that is higher than the crystallization temperature of the organic semiconductor compound to form a mixed composition and orienting the mixed composition in the second liquid crystalline phase exhibited within a predetermined temperature range to cause molecules of the organic semiconductor compound to be oriented.

[18] The conductive thin film according to claim 17, wherein said first liquid crystalline phase is a smectic liquid crystalline phase, while said second liquid crystalline phase is a nematic liquid crystalline phase.

[19] The conductive thin film according to claim 17, wherein said organic semiconductor compound is an organic semiconductor compound comprising a low polymer organic semiconductor compound.

[20] The conductive thin film according to claim 17, wherein said mixed composition is a mixed composition containing 70 to 98 wt% of said organic semiconductor compound.

[21] The conductive thin film according to claim 20, wherein said mixed composition is a mixed composition containing 90 to 95 wt% of said organic semiconductor compound.

[22] The conductive thin film according to claim 17, wherein said organic semiconductor compound is an organic semiconductor compound comprising an oligothiophene derivative.

[23] A method of fabricating a conductive thin film, comprising: mixing a first material having electric conductivity or semiconductivity and a second material to prepare a mixture; and orienting the mixture by utilizing liquid crystallinity thereof.

[24] The method according to claim 23, which comprises: mixing at least nanotube comprising at least one of metallic nanotube and semiconductive nanotube and a liquid crystalline organic compound together; and orienting molecules of the liquid crystalline organic compound to cause molecules of the nanotube to be oriented.

[25] The method according to claim 24, wherein carbon nanotube is used as said nanotube.

[26] The method according to claim 24, wherein a liquid crystalline organic compound having at least one of a nematic liquid crystalline phase and a smectic liquid crystalline phase is used as said liquid crystalline organic

compound.

[27] The method according to claim 24, wherein a liquid crystalline organic compound having a charge transport function is used as said liquid crystalline organic compound.

[28] The method according to claim 24, wherein a liquid crystalline organic compound having at least l 6π-electron aromatic rings, m 10π-electron aromatic rings or n 14π-electron aromatic rings (wherein l+m+n = 1 to 4; and l and n are each an integer from 0 to 4) is used as said liquid crystalline organic compound.

[29] The method according to claim 28, wherein a liquid crystalline organic compound having at least any one of a 2-phenylnaphthalene ring, a biphenyl ring, a benzothiazole ring and a t-thiophene ring and a substantially rod-like molecular structure is used as said liquid crystalline organic compound.

[30] The method according to claim 23, which comprises: mixing at least a non-liquid-crystalline organic semiconductor compound and a non-liquid-crystalline organic compound to form a liquid crystalline organic semiconductor mixture; and orienting molecules of the liquid crystalline organic semiconductor mixture to cause molecules of the organic semiconductor compound to be oriented.

[31] The method according to claim 30, wherein a liquid crystalline organic semiconductor mixture in which said organic semiconductor compound and said organic compound are hydrogen-bonded to each other is used as said liquid crystalline organic semiconductor mixture.

[32] The method according to claim 31, wherein a compound having at least one element selected from nitrogen, oxygen, sulfur and halogen is used as one of said organic semiconductor compound and said organic compound and the element selected is hydrogen-bonded to hydrogen.

[33] The method according to claim 32, wherein a compound further having one of an unsaturated bond and a benzene ring is used as the one of said organic semiconductor compound and said organic compound which has at least said element selected.

[34] The method according to claim 30, wherein a derivative comprising an organic semiconductor compound of at least any one of an acene type, a phthalocyanine type and a thiophene type is used as said organic semiconductor compound.

[35] The method according to claim 34, wherein a pentacene derivative is used as the derivative comprising an organic semiconductor compound of said acene type.

[36] The method according to claim 34, wherein a copper phthalocyanine derivative is used as the derivative comprising an organic semiconductor compound of said phthalocyanine type.

[37] The method according to claim 30, which comprises: orienting molecules of said liquid crystalline organic semiconductor mixture to cause molecules of said organic semiconductor compound to be oriented; and then removing said organic compound from said liquid crystalline organic semiconductor mixture.

[38] The method according to claim 37, which comprises removing said organic compound from said liquid crystalline organic semiconductor mixture by at least one of heating and ultraviolet irradiation.

[39] The method according to claim 23, which comprises: mixing at least an organic semiconductor compound having a first liquid crystalline phase in which crystallization temperature allowing crystallization from the liquid crystalline phase to occur is not lower than room temperature and an organic

compound exhibiting a second liquid crystalline phase of a lower orientational order than the first liquid crystalline phase within a temperature range that is higher than the crystallization temperature of the organic semiconductor compound to form a mixed composition; and orienting the mixed composition in the second liquid crystalline phase exhibited within a predetermined temperature range to cause molecules of the organic semiconductor compound to be oriented.

[40] The method according to claim 39, wherein a smectic liquid crystalline phase is used as said first liquid crystalline phase and a nematic liquid crystalline phase is used as said second liquid crystalline phase.

[41] The method according to claim 39, wherein an organic semiconductor compound comprising a low polymer organic semiconductor compound is used as said organic semiconductor compound.

[42] The method according to claim 41, wherein a mixed composition containing 70 to 98 wt% of said organic semiconductor compound is used as said mixed composition.

[43] The method according to claim 42, wherein a mixed composition containing 90 to 95 wt% of said organic semiconductor compound is used as said mixed composition.

[44] The method according to claim 39, wherein an organic semiconductor compound comprising an oligothiophene derivative is used as said organic semiconductor compound.

[45] A thin film transistor comprising a conductive thin film as recited in claim 1 as a semiconductor layer forming a channel layer.

[46] The thin film transistor according to claim 45, wherein said conductive thin film is a conductive thin film formed by mixing at least nanotube comprising at least one of metallic nanotube and semiconductive nanotube and a

liquid crystalline organic compound together and orienting molecules of the liquid crystalline organic compound to cause molecules of the nanotube to be oriented.

[47] The thin film transistor according to claim 45, wherein said conductive thin film is a conductive thin film formed by mixing at least a non-liquid-crystalline organic semiconductor compound and a non-liquid-crystalline organic compound to form a liquid crystalline organic semiconductor mixture and orienting molecules of the liquid crystalline organic semiconductor mixture to cause molecules of the organic semiconductor compound to be oriented.

[48] The thin film transistor according to claim 45, wherein said conductive thin film is a conductive thin film formed by mixing at least an organic semiconductor compound having a first liquid crystalline phase in which crystallization temperature allowing crystallization from the liquid crystalline phase to occur is not lower than room temperature and an organic compound exhibiting a second liquid crystalline phase of a lower orientational order than the first liquid crystalline phase within a temperature range that is higher than the crystallization temperature of the organic semiconductor compound to form a mixed composition and orienting the mixed composition in the second liquid crystalline phase exhibited within a predetermined temperature range to cause molecules of the organic semiconductor compound to be oriented.

[49] A method of fabricating a thin film transistor, comprising a method of fabricating a conductive thin film as recited in claim 23 as a method of fabricating a conductive thin film serving as a semiconductor layer forming a channel layer.

[50] The method according to claim 49, wherein said method of fabricating a conductive thin film comprises the steps of: mixing at least nanotube comprising at least one of metallic nanotube and semiconductive nanotube and a

liquid crystalline organic compound together; and orienting molecules of the liquid crystalline organic compound to cause molecules of the nanotube to be oriented.

[51] The method according to claim 49, wherein said method of fabricating a conductive thin film comprises the steps of: mixing at least a non-liquid-crystalline organic semiconductor compound and a non-liquid-crystalline organic compound to form a liquid crystalline organic semiconductor mixture; and orienting molecules of the liquid crystalline organic semiconductor mixture to cause molecules of the organic semiconductor compound to be oriented.

[52] The method according to claim 49, wherein said method of fabricating a conductive thin film comprises the steps of: mixing at least an organic semiconductor compound having a first liquid crystalline phase in which crystallization temperature allowing crystallization from the liquid crystalline phase to occur is not lower than room temperature and an organic compound exhibiting a second liquid crystalline phase of a lower orientational order than the first liquid crystalline phase within a temperature range that is higher than the crystallization temperature of the organic semiconductor compound to form a mixed composition; and orienting the mixed composition in the second liquid crystalline phase exhibited within a predetermined temperature range to cause molecules of the organic semiconductor compound to be oriented.

[53] An image display device comprising a conductive thin film as recited in claim 1 as at least one of a conductive layer and a semiconductor layer forming a channel layer of a thin film transistor.

[54] The image display device according to claim 53, wherein said conductive thin film is a conductive thin film formed by mixing at least nanotube comprising at least one of metallic nanotube and semiconductive nanotube and a liquid crystalline organic compound together and orienting molecules of the liquid

crystalline organic compound to cause molecules of the nanotube to be oriented.

[55] The image display device according to claim 53, wherein said conductive thin film is a conductive thin film formed by mixing at least a non-liquid-crystalline organic semiconductor compound and a non-liquid-crystalline organic compound to form a liquid crystalline organic semiconductor mixture and orienting molecules of the liquid crystalline organic semiconductor mixture to cause molecules of the organic semiconductor compound to be oriented.

[56] The image display device according to claim 53, wherein said conductive thin film is a conductive thin film formed by mixing at least an organic semiconductor compound having a first liquid crystalline phase in which crystallization temperature allowing crystallization from the liquid crystalline phase to occur is not lower than room temperature and an organic compound exhibiting a second liquid crystalline phase of a lower orientational order than the first liquid crystalline phase within a temperature range that is higher than the crystallization temperature of the organic semiconductor compound to form a mixed composition and orienting the mixed composition in the second liquid crystalline phase exhibited within a predetermined temperature range to cause molecules of the organic semiconductor compound to be oriented.

[57] An electronic device comprising a conductive thin film as recited in claim 1 as at least one of a conductive layer and a semiconductor layer forming a channel layer of a thin film transistor.

[58] The electronic device according to claim 57, wherein said conductive thin film is a conductive thin film formed by mixing at least nanotube comprising at least one of metallic nanotube and semiconductive nanotube and a liquid crystalline organic compound together and orienting molecules of the liquid crystalline organic compound to cause molecules of the nanotube to be oriented.

[59] The electronic device according to claim 57, wherein said conductive thin film is a conductive thin film formed by mixing at least a non-liquid-crystalline organic semiconductor compound and a non-liquid-crystalline organic compound to form a liquid crystalline organic semiconductor mixture and orienting molecules of the liquid crystalline organic semiconductor mixture to cause molecules of the organic semiconductor compound to be oriented.

[60] The electronic device according to claim 57, wherein said conductive thin film is a conductive thin film formed by mixing at least an organic semiconductor compound having a first liquid crystalline phase in which crystallization temperature allowing crystallization from the liquid crystalline phase to occur is not lower than room temperature and an organic compound exhibiting a second liquid crystalline phase of a lower orientational order than the first liquid crystalline phase within a temperature range that is higher than the crystallization temperature of the organic semiconductor compound to form a mixed composition and orienting the mixed composition in the second liquid crystalline phase exhibited within a predetermined temperature range to cause molecules of the organic semiconductor compound to be oriented.